p-Harmonic measure is not additive on null sets

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Dedicated to the memory of Tom Wolff.
Without his work this note would not have been possible.

Abstract. When $1 < p < \infty$ and $p \neq 2$ the p-harmonic measure on the boundary of the half plane $\mathbb{R}^2_+$ is not additive on null sets. In fact, there are finitely many sets E_1, E_2,...,E_κ in $\mathbb{R}$, of p-harmonic measure zero, such that $E_1 \cup E_2 \cup ... \cup E_\kappa = \mathbb{R}$.